WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electric Code (ANSI C1) or any other requirements applicable to your installation. Installing, operating, and maintaining this instrument should only be performed by qualified personnel.

TM-114775
VOLUME 1 -- OPERATOR'S MANUAL

626-PA-6031

SINGLE-PHASE AC GRAPHICS MONITOR

June 1990

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NOTE: Refer to Volume 2 of TM-114775 for Service instructions.

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DRANETZ TECHNOLOGIES, INC.
1000 New Durham Road
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CAUTION REGARDING FCC COMPLIANCE

This instrument generates, uses, and can radiate radio frequency energy. If is not installed and used in accordance with this Operator's manual, it may cause interference with radio communications. This instrument complies with the limits for a Class "A" computing device pursuant to Subpart J of Part 15 of FCC rules. These rules are designed to provide reasonable protection against such interference when the instrument is operated in a commercial environment. Operating this instrument in a residential area is likely to cause interference, in which case the user, at his or her own expense, is required to take whatever measures necessary to correct the problem.

VOLUME 1
OPERATOR'S MANUAL

626-PA-6031 SINGLE-PHASE AC GRAPHICS MONITOR

SECTION I
GENERAL INFORMATION

1.1 SCOPE

The manual for this product consists of two volumes. You are reading Volume 1, the Operator's manual, which is divided into three main sections:

I. GENERAL INFORMATION
II. INSTALLATION AND OPERATION
III. OPERATIONAL TESTS

Volume 2, the Service/Maintenance manual, contains four sections (refer to Subsection 1.10 for information on obtaining Volume 2):

IV. THEORY OF OPERATION
V. MAINTENANCE AND CALIBRATION
VI. REPLACEABLE PARTS
VII. SCHEMATICS AND ASSEMBLIES

1.2 INTRODUCTION

This manual provides Operator's instructions for the 626-PA-6031 Single-Phase Graphics Monitor plug-in module, also referred to as the 6031 plug-in. The plug-in is designed for installation in the Series 626 Universal Disturbance Analyzer. (When reading this manual, the terms "Series 626" and "Mainframe" refer to any model of the Series 626 Universal Disturbance Analyzer.)

The Mainframe provides all system functions, including power and real-time clock, for its plug-in modules. Before reading these instructions further, you should be familiar with the Mainframe information described in the Series 626 Mainframe manual.

A keyboard located on the front panel of the Mainframe[1] controls Mainframe and plug-in operation. The Mainframe and plug-ins can also be controlled remotely from a PC or data terminal.

Data collected by the 6031 is sent to the Mainframe's internal stack before being printed and/or sent to the Mainframe's RS-232 port.[2]

NOTE: *The Model 626's printout is read from the bottom up. The printouts of all other models of the Series 626 are read from the top down. In this manual, the printout examples are read from the top down.*

---

[1]The Model 626R Mainframe has no keyboard. It is programmed and controlled remotely from a PC or terminal.
[2]Refer to the Mainframe manual for specific information about the internal stack, printer, RS-232 port, and remote communications.

1.3 PURPOSE

The 6031 plug-in monitors both voltage and current disturbances on a single phase AC power line with a nominal frequency of either 50 or 60 Hz. Line to neutral, neutral to ground and current disturbances are measured and categorized.

If the 626 Mainframe is a model 626G, graphical disturbance data is printed along with the text information for all events except frequency events.

Using any model of Mainframe, graphical disturbance data can be sent to the Mainframe's serial port and printed using a 626GP (or compatible) printer.[3]

Channel A monitors line to neutral disturbances, categorizing them as sags, surges, undervoltages, overvoltages, impulses, and frequency events. Channel B monitors neutral to ground disturbances classifying them as surges, overvoltages, and impulses. Channel C monitors current disturbances and classifies them as surges and overcurrents.

1.4 APPLICATIONS

When installed in the Series 626 Mainframe, the 6031 plug-in provides the capability of monitoring and evaluating power system performance. Among its typical applications are:

a. Determining the effect of power systems operation on equipment malfunction. Power line faults may be rapidly correlated according to errors, outages, and equipment damage in computers, industrial process controls, digital communications equipment, medical monitoring apparatus, etc. Correlation is accomplished by a time-referred fault disturbance record produced by the 6031 plug-in and printed by either the Mainframe's printer or a Graphics Printer.

b. Performing pre-installation site surveys. The 6031 plug-in can be used to determine the adequacy of existing power lines that are intended to support critical electrical equipment. (Anticipation of power problems before they occur saves time, money, and future problems.)

c. Diagnostic evaluation of power system performance. The portability of the Series 626 Mainframe with its plug-ins, including the 6031 plug-in, makes it well suited for field use, and it is thus ideal for determining the probable cause of, and remedies for, power line disturbances.

d. Monitoring life test racks. The printouts produced by the 6031 plug-in (via the Series 626 or Graphics Printer) provide a clear record of the quality of power supplied during unattended periods of operation.

1.5 EQUIPMENT CHARACTERISTICS

The 6031 plug-in is configured as a plug-in module 6-1/2" high by 2-1/2" wide by 10" deep. It is designed for installation into the Series 626 Mainframe. The 6031 plug-in occupies two of the five slots available in the Mainframe.

[3]Refer to Appendix A for information on compatible printers.

1.5.1 Plug-in Output

The plug-in outputs textual descriptions of monitored events to the Mainframe's front panel printer. If the Mainframe is a 626G, this output includes graphics.

The plug-in's output to the Mainframe's RS-232 port is user selectable between text, graphics, or raw data.

If the text mode is selected, textual descriptions of the recorded events are sent to the RS-232 port without graphics. [4]

If the graphics mode is selected, graphical data accompanies the textual descriptions sent to the RS-232 port. Graphics to the RS-232 port are limited to a two inch wide graph. Graphics ranges are automatically selected based on each channels programmed high limit value.

If the raw data mode is selected, data is sent to the RS-232 port using only printable ASCII characters in order to be compatible with all mass storage plug-ins. [4]

1.6 626-PA-6031 TECHNICAL SPECIFICATIONS

Technical specifications for the 6031 plug-in are presented in Table 1-1.

TABLE 1-1. 626-PA-6031 PRELIMINARY TECHNICAL SPECIFICATIONS (Page 1 of 3)

LINE TO NEUTRAL, CHANNEL A	
Range	10 - 600 V RMS, 47 - 63 Hz
Resolution	0.2 V
Accuracy	±1% reading,±0.2% F.S.
Impulse Range	50 - 4000 V pk
Resolution	1 V pk
Accuracy	For 100 - 4000 V pk ±10% reading ±1% F.S. (5 µSec - 50 µSec) Typically -6 dB @ 1 µSec and 2 mSec
Impulse Duration Range	1 µSec to 2 mSec
NEUTRAL TO GROUND, CHANNEL B	
Range	1 - 60 V RMS
Resolution	0.1 V
Accuracy	±1% reading, ±0.2% F.S.
Impulse Range	5 - 400 V pk
Resolution	1 V pk
Accuracy	±10% reading, ±1% F.S. (5 µSec - 50 µSec) Typically -6 dB @ 1 µSec and 2 mSec
Impulse Duration Range	1 µSec to 2 mSec
CURRENT, CHANNEL C	
Range	0.5 - 30 Arms
Resolution	0.1 A
Accuracy	2% reading, +/- 0.5% FS

[4]The text and raw data modes are compatible with Dranetz Data Acquisition Software (DAS) and Dranetz Data Management II (DMII) software.

TABLE 1-1. 626-PA-6031 PRELIMINARY TECHNICAL SPECIFICATIONS (Page 2 of 3)

GRAPHICS		
Ranges:		
Line to Neutral		250, 500, and 1000 V pk
Neutral to Ground		25, 50, and 100 V pk
Current		15, 30, and 60 A pk
Resolution:		
	Channel A (L-N)	2 V on 250 V range 4 V on 500 V range 8 V on 1000 V range
	Channel B (N-G)	0.2 V on 25 V range 0.4 V on 50 V range 0.8 V on 100 V range
	Channel C (I)	0.12 A on 15 A range 0.24 A on 30 A range 0.48 A on 60 A range
Sampling rate		3.91 kHz
Accuracy:		
Line Voltage/Current		±5% reading ±2.5% F.S.
Impulses		±10% of reading ±10% F.S. for > 100 V pk/10 V pk/10 A pk, >10 µSec Typically -6 dB at 2 µSec
PROGRAMMING LIMITS		
Line to neutral		
	Hi Limit	51 - 600 V
	Lo Limit	50 - 599 V
	Sensitivity	2 - 60 V
	Impulse	50 - 4000 V pk
	Freq. Sens.	0.2 - 3.0 Hz (0.1 Hz steps)
Neutral to ground*		
	Hi Limit	2 - 60 V
	Impulse	5 - 400 V pk
Current*		
	Hi Limit	1 - 30 A

*Sensitivity on the neutral to ground and current channels is fixed at 12.5% of the programmed high limit value, with a minimum of 0.6 V and 0.2 A, respectively.

TABLE 1-1. 626-PA-6031 PRELIMINARY TECHNICAL SPECIFICATIONS (Page 3 of 3)

GRAPHICS RANGE SELECTION

Programmed High Limit	Graphics Range
Line to neutral, Channel A	
51 - 135 V	250 V pk
136 - 319 V	500 V pk
320 - 600 V	1000 V pk
Neutral to ground, Channel B	
2 - 9 V	25 V pk
10 - 18 V	50 V pk
19 - 60 V	100 V pk
Current, Channel C	
1 - 4 A	15 A pk
5 - 8 A	30 A pk
9 - 30 A	60 A pk

Effect of Printout Mode switch on graphs.

Printout Mode	Graphics Output
Summary Only	Graphs are not printed
Out of Limits	An event on Channel A will print graphs of all active channels.* An event on Channel B will print a graph of Channel B only. An event on Channel C will print a graph of Channel C only.
Normal	Same as Out of Limits.
Maximum Detail	An event on any channel will print graphs of all active channels.*

*An active channel is defined as any channel where a signal is detected.

1.7 STANDARD ACCESSORIES

Part #	Quantity	Description
TM-114775	1	Operator's Manual
114781-G1	1	Cable Set
TR2021	1	TR2021 Current Probe

1.7.1 REQUIRED ACCESSORIES

The Series 626 Mainframe is required for operating the 6031 plug-in. If graphics printouts are desired, use:

- a Model 626G Mainframe or
- any Series 626 Mainframe with:
  - a Model 626GP Graphics Printer or
  - any fully compatible printer (see Appendix A for additional printer information).

1.8 OPTIONAL ACCESSORIES

Part #	Quantity	Description
TM-114775 Vol. 2	1	Service (Maintenance) Manual

1.9 FACTORY REPAIR

When factory repair is required, proceed as follows:

1. Contact Dranetz Customer Service Department to obtain an authorization number for factory repair:

Tel:	(908) 287-3680	Telex:	499-7808
FAX:	(908) 248-9240	Cable:	DRANETZ
TWX:	(908) 997-9553		

2. Fill out the REPAIR/SERVICE ORDER form in this manual and ship it along with the malfunctioning equipment to Dranetz Customer Service Department. If this form is missing, contact Dranetz to request a replacement.

3. You have been supplied a Control Form in this manual. This form is used if you want the Volume 2 of this manual (for Service and Maintenance). If this form is missing, contact Dranetz to request a replacement.

SECTION II
INSTALLATION AND OPERATION

2.1 GENERAL

This section contains the installation, programming, and operating instructions for the 6031 Single Phase Graphic Monitor plug-in module.

2.2 INSTALLATION

Installation consists of:

1) Installing the 6031 in the Mainframe
2) Connecting the 6031 inputs to lines to be monitored

You should read through the entire installation procedure before beginning installation.

2.2.1 Load Ratings

The Series 626 standard Mainframe has an upper limit of the combined total rating of its installed modules. The overall Mainframe capacity is set at 20 units. The load ratings for all the individual plug-in modules existing as of this printing are listed in TABLE 2-1.

TABLE 2-1. LOAD RATINGS

Plug-in	Load Rating	Plug-in	Load Rating
626-PA-6001	2 Units	626-PA-6013	2 Units
626-PA-6001 with Extra Option Board	3 Units	626-PA-6014	1 Unit
		626-PA-6015	4 Units
		626-PA-6018	4 Units
626-PA-6002	2 Units	626-PA-6020	4 Units
626-PA-6003	4 Units	626-PA-6024	4 Units
626-PA-6005	2 Units	626-PA-6024B	4 Units
626-PA-6006	2 Units	626-PA-6025	4 Units
626-PA-6007	1 Unit	626-PA-6030	6 Units
626-PA-6008	2 Units	626-PA-6037	1 Unit
626-PA-6009	4 Units	626-PA-6038	1 Unit
626-PA-6011	1 Unit	626-PA-6038	1 Unit
626-PA-6012	2 Units	626-PA-6040	6 Units
626-PA-6012A	3 Units	626-PA-6031	6 Units

NOTE: *When selecting modules for installation into any Series 626 Mainframe, verify that the sum of the load ratings of the installed modules DOES NOT exceed 20 units.*

2.2.1 Installation Warning

WARNING

Be sure that the Series 626 Mainframe and all of the power connected to its plug-in modules are first turned OFF before proceeding with any installation.

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electric Code (ANSI C1) and/or any other requirements which are applicable to the user. Installation, operation, and maintenance should be performed ONLY by qualified personnel. Qualifications for performing such procedures should be self-determined.

2.2.3 Installation Procedure

NOTE: *Two slot positions are required by the 6031 plug-in.*

To install the 6031 plug-in into the Mainframe, proceed as follows:

1) Make sure the Mainframe and all power connected to its plug-ins are turned off.

2) Remove the 6031 plug-in from its packing.

3) The slots on the rear of the Mainframe are covered with a metal cover plate when they are empty. Remove the cover plates from the two adjacent slot positions where you will install the plug-in.

4) Position the top and bottom front corners of the plug-in module into the upper and lower tracks of the two adjacent slots. Carefully slide the module into the Mainframe until it is firmly seated.

5) Tighten the top and bottom captive screws in order to secure the module to the Mainframe.

2.2.4 Connecting 6031 Module to Lines to be Monitored

CAUTION

To avoid damaging the equipment, DO NOT apply AC voltages in excess of 600 V RMS to any of the voltage inputs of the 6031 plug-in.

WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electric Code (ANSI C1), or any other requirements, or both, which may be applicable to the user.

Installation, operation, and maintenance should only be performed by qualified personnel. Your qualifications for doing so should be self-determined.

Connections to the power line are made from the 6031's rear panel, illustrated in FIGURE 1-1. The 6031 is equipped with three safety banana jacks for voltage, one audio style connector for a current probe, and a five-way binding post for safety ground. The connections are labeled Line, Neutral, Ground, Current Probe, and Safety Ground, from top to bottom of the rear panel.

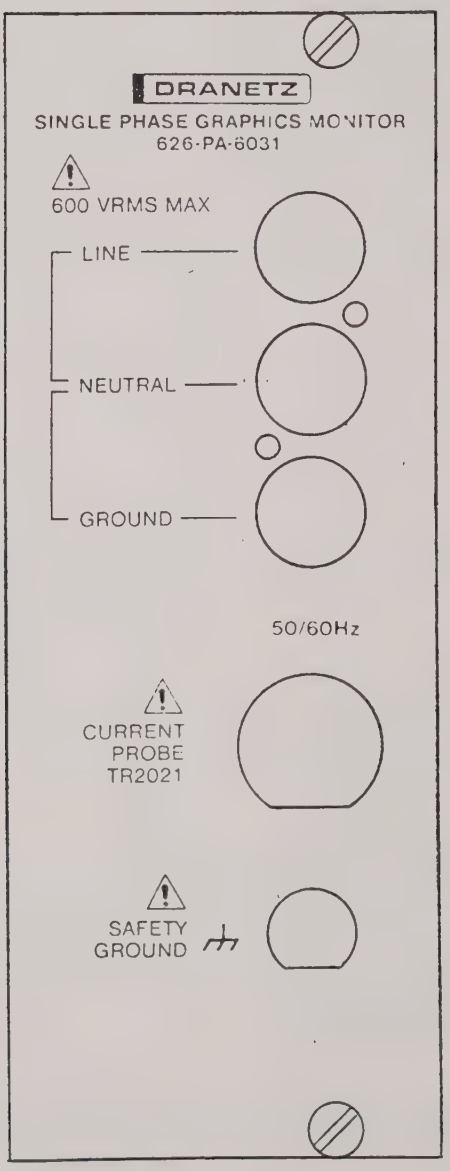


FIGURE 1-1. 6031 REAR PANEL.

To connect the 6031 plug-in module to the lines to be monitored, proceed as follows:

1) If the Series 626 is on, turn off the unit by inserting the key into the FUNCTION key switch and setting the switch to "OFF."

2) Turn off the power source that is going to be monitored by the plug-in.

3) Make all connections to the 6031 first, using the cables supplied with the plug-in.

4) The safety ground input on the rear panel of the 6031 is connected internally to the safety grounding conductor in the Mainframe's power plug. Connect the safety ground input to a suitable earth safety ground using the green ground cable provided. (This connection assures operator's safety if the power cord is accidently disconnected.) Be sure to use a grounding point at the same potential as the AC power cord ground, to avoid inducing current flow due to different ground point potentials.

5) Make the desired connections to the power source that is going to be monitored. Follow the connection configuration example in FIGURE 1-2.

6) Turn on the Series 626 by turning the FUNCTION key switch to "OPERATE."

7) Turn on the power source that is going to be monitored.

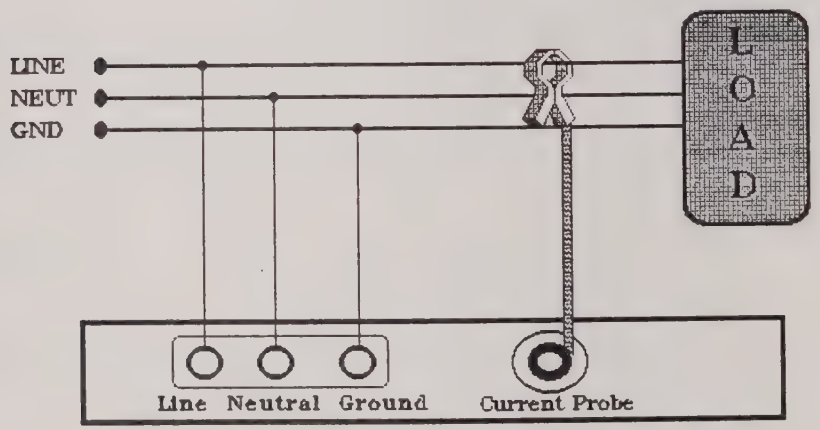


FIGURE 1-2. 6031 CONNECTION CONFIGURATION EXAMPLE

2.3 MONITORING GUIDELINES

Proper monitoring and analysis of AC and DC voltage disturbances requires careful attention to the method of connection between the Series 626 Mainframe and the monitored circuit. To obtain the most accurate and relevant voltage monitoring data, follow these suggested guidelines.

1) To minimize spurious impulse transients and interchannel coupling, always use the Dranetz measurement cables supplied with the plug-in.

2) Measurement cable length should be minimized, preferably less than 8 feet from the Mainframe to the circuit connection point. This minimizes amplitude variation of impulse transients.

3) If monitoring a power line connected to critical, sensitive load equipment, the test cable should be connected to the power line as close as possible to the load.

4) Use of instrument-grade Potential Transformers for monitoring impulses on high voltage power lines is not recommended. The limited frequency response of most Potential Transformers may result in substantial variation of impulse amplitude.

5) The Mainframe is designed to operate from disturbed power lines, therefore, its power supply may be connected to the same power line that is being monitored. However, be aware that the extensive transient suppression incorporated with the Mainframe power supply may alter the transient characteristics of the AC power line that the power supply is connected to.

   To prevent alterations of the transient characteristics of the power line being monitored, separate the Mainframe's power supply input from the monitored inputs.

6) The safety ground terminal of the plug-in module is connected internally to the safety grounding conductor in the Mainframe's power plug.[1] Be careful not to inadvertently contaminate a "clean" ground with a "dirty" ground.

2.4 OPERATING THE 6031 PLUG-IN

The following subsections contain information pertaining to the operation of the 6031 plug-in. Once the proper hardware connections are made, the steps involved in operating the 6031 involve:

- programming the 6031
- allowing the 6031 time to monitor the power lines and record events
- viewing and analyzing recorded data

6031 operation is performed through the Mainframe the plug-in is installed in. The Model 626R Mainframe can be controlled remotely from a PC or Terminal. All other models of the Series 626 can be controlled remotely from a PC or Terminal, or locally from the Mainframe's Keyboard.

2.4.1 Mainframe Operating Controls and Indicators

The functions of the Mainframe operating controls and indicators associated with 6031 plug-in operation are described in TABLE 2-2. FIGURE 2-1 illustrates the typical front panel controls on a Series 626 that are associated with a 6031 plug-in. For a description of controls common to overall Series 626 operation, refer to Volume 1 of the Mainframe manual.

[1]Make sure that the safety ground is connected to a verified safety ground using the green grounding cable provided. Use a grounding point at the same potential as the AC power cord ground to avoid inducing current flow due to different ground point potentials.

TABLE 2-2. 6031 PLUG-IN OPERATING CONTROLS

ITEM	FUNCTION
Numerical Keys*	Used to enter numerical values or to select menu options.
[LO LIMIT] Key	Enables Low limit voltage to be programmed from the numerical keyboard.
[HI LIMIT] Key	Enables High Limit voltage or current to be programmed from the numerical keyboard.
[SENS] Key	Enables Voltage Sensitivity threshold to be programmed from the numerical keyboard.
[IMP SENS] Key	Enables Impulse Sensitivity threshold to be programmed from the numerical keyboard.
[F SENS] Key	Enables Frequency Sensitivity value to be programmed from the numerical keyboard.
[ENTER] Key	Transfers the entered numerical value into the plug-in's memory.
[CLEAR ENTRY] Key	This key performs one of two different functions during programming of the 6031 thresholds. When pressed in the middle of entering a numerical sequence, [CLEAR ENTRY] clears the numbers just selected. When pressed either after or before entering a numerical sequence, [CLEAR ENTRY] returns you to the first channel (channel A) for re-programming.
[RANGE] Key	Enables selection of RS-232 output mode between text, graphics, or raw data.
[FNC] Key	Selects the next channel to be programmed (progresses from A to B to C.)
[PROG] Button*	Causes Program Summary to be printed.
[DATA] Button	Causes Data Summary to be printed.
[PRESET] Button	Pressing [PRESET] when the FUNCTION key switch is set to "PROGRAM" causes the factory default settings for the selected channel to be programmed into the plug-in's memory.

* "Key" and "Keyboard" refer to the red, green, and yellow keys; "Button" refers to the black selector buttons.

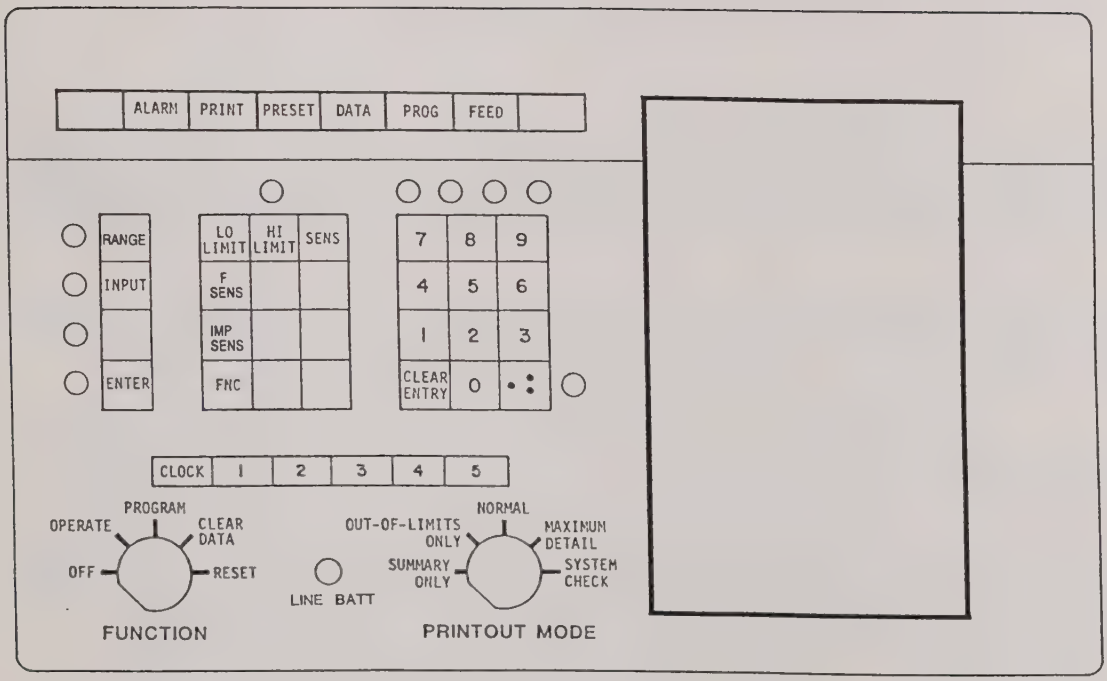


FIGURE 2-1. MAINFRAME FRONT PANEL CONTROLS ASSOCIATED WITH A 6031 PLUG-IN.

2.4.2 Programmable Thresholds

For channel A, the Line-to-Neutral channel, the programmable thresholds are:

- voltage high limit
- voltage low limit
- voltage sensitivity
- frequency sensitivity
- impulse sensitivity

For channel B, the Neutral-to-Ground channel, the programmable thresholds are:

- voltage high limit
- impulse sensitivity

For channel C, the current channel, the programmable threshold is:

- current high limit

When the monitored line voltage exceeds the programmed high limit or drops below the programmed low limit, an event is recorded. It is recommended that the high and low limits be set to at least 3 volts (respectively) from the nominal voltage being measured. For example, if monitoring 120 volts, the high limit should be set to at least 123 volts and the low limit to at most 117 volts.

The voltage and frequency sensitivities set the deviation from the present value, above or below which a detected value produces a recorded disturbance. It is recommended that the voltage sensitivity be set to a value that is equal to or greater than 2% of the nominal input voltage.

For impulse measurements, the sensitivity corresponds to the absolute threshold, so that for an impulse sensitivity of 50 volts, a disturbance is recorded when the impulse amplitude rises above 50 volts.

On channel B the voltage sensitivity is a fixed percentage (12.5%) of the user programmed high limit. On channel C the current sensitivity is a fixed percentage (12.5%) of the user programmed high limit. Care should be used when setting all high limit values as they determine the graphics full scale range for their respective channels (see specifications for range switch points).

2.5.2 Programming Procedure

The programming procedure for the 6031 is similar to other plug-modules. Remote and local programming procedures are demonstrated in the following two subsections for the example on the next page.

Suppose you wish to set the 6031 plug-in as follows:

RS232 Output Mode: Text

Channel A

high limit:	125 volts
low limit:	105 volts
voltage sensitivity:	5 volts
frequency sensitivity:	0.2 Hz
impulse sensitivity:	50 volts

Channel B

high limit:	12 volts
impulse sensitivity:	10 volts

Channel A

high limit:	5 amps

2.5.2.1 Local Programming Example

Local programming of the 6031 plug-in is accomplished through the Mainframe.

When programming the plug-in, the PRINTOUT MODE key switch on the Mainframe's front panel can be set to any position except "SYSTEM CHECK". To program the 6031 plug-in for the settings in this example, follow the steps outlined below.

NOTE: *Pressing [CLEAR ENTRY] while the LEDs over the numeric keypad are lit will clear the numeric entry. If [CLEAR ENTRY] is pressed while the function keypad is active the entire program routine will be repeated.*

1) Set the FUNCTION key switch on the Mainframe's front panel to "PROGRAM".

2) Since the 6031 plug-in occupies two slots, push the lower of the two black buttons of the two slots being occupied (for example, press [2] when slots 2 and 3 are occupied.) A Program Summary for that channel is immediately printed.

3) The cueing indicator next to the [RANGE] key lights, indicating that [RANGE] should now be pressed.

4) Press [RANGE] to select the output mode. A prompt such as the one below is printed.

```
SELECT RS232
OUTPUT:
 0 = TEXT
 1 = GRAPHICS
 2 = RAW DATA
```

5) Press [0] to select text only. Press [ENTER] to accept this selection. The 626 prints out confirmation of your selection, and prompts you to program the settings for channel A.

```
RS232 OUT:TEXT
A:L-N
```

6) Press [HI LIMIT] to program the voltage high limit for channel A. Three yellow LEDs light above the numeric keypad, indicating that the 626 expects a three digit entry.[2] Press [1] [2] [5] to set the high limit at 125 volts. (As each digit is pressed, one of the yellow LEDs above the numeric keypad goes out, indicating that the digit was read in.) After all three digits have been pressed, the green LED next to the [ENTER] key lights. Press [ENTER] to accept the value just typed.

7) Press [LO LIMIT] to program the voltage low limit for channel A. Three yellow LEDs light above the numeric keypad as in step 6. Press [1] [0] [5] to set the low limit at 105 volts. After all three digits have been pressed, the green LED next to the [ENTER] key lights. Press [ENTER] to accept this value.

8) Press [SENS] to program the voltage sensitivity for channel A. Two yellow LEDs light above the numeric keypad indicating that the 626 expects a two digit entry. Since the desired setting only contains one digit, a leading zero must be entered. Press [0] [5] to set the sensitivity at 5 volts. The green LED next to the [ENTER] key lights. Press [ENTER] to accept this value.

9) Press [F SENS] to program the frequency sensitivity for channel A. One yellow LED lights above the numeric keypad. Press [2] to set the sensitivity to 0.2 Hz. The green LED next to the [ENTER] key lights. Press [ENTER] to accept this value.

10) Press [IMP SENS] to program the impulse sensitivity for channel A. Four yellow LEDs light above the numeric keypad to indicate that four digits must be entered. Since the desired setting only contains two digits, leading zeros must be entered. Press [0] [0] [5] [0] to set the sensitivity to 50 volts. The green LED next to the [ENTER] key lights. Press [ENTER] to accept this value.

11) Press [FNC] to progress to channel B, the next channel to be programmed. A prompt such as the following is printed:

```
B:N-G
```

12) Press [HI LIMIT] to program the voltage high limit for channel B. Three yellow LEDs light above the numeric keypad, indicating that the 626 expects a three digit entry. Since the desired setting only contains two digits, a leading zero must be entered. Press [0] [1] [2] to set the high limit at 12 volts. The green LED next to the [ENTER] key lights. Press [ENTER] to accept this value.

13) Press [IMP SENS] to program the impulse sensitivity for channel B. Three yellow LEDs light above the numeric keypad to indicate that three digits must be entered. Since the desired setting only contains two digits, a leading zero must be entered. Press [0] [0] [1] [0] to set the sensitivity to 10 volts. The green LED next to the [ENTER] key lights. Press [ENTER] to accept this value.

14) Press [FNC] to progress to channel C, the next channel to be programmed. A prompt such as the following is printed:

```
C:AMPS
```

[2] If the desired entry is less than three digits, enter leading zeros so that the expected number of digits are entered.

15) Press [HI LIMIT] to program the voltage high limit for channel C. Two yellow LEDs light above the numeric keypad, indicating that the 626 expects a two digit entry. Since the desired setting only contains one digit, a leading zero must be entered. Press [0] [5] to set the high limit at 5 amps. The green LED next to the [ENTER] key lights. Press [ENTER] to accept this value.

16) Press [PROG] for a program summary printout to verify the settings you just set. The summary printout resembles the sample printout below:

```
RS232 OUTPUT TEXT

A:L-N
V HIGH LIMIT 125 V
V LOW LIMIT  105 V
VOLTAGE SENS 005 V
FREQ SENS    0.2HZ
IMPULSE SENS 0050V

B:N-G
V HIGH LIMIT 012 V
IMPULSE SENS 0010V

C:AMPS
HIGH LIMIT   005 A
```

NOTE: *After programming the Series 626 plug-ins, be sure to set the FUNCTION key switch on the Mainframe's front panel to "OPERATE". The Series 626 will not record events while in the "PROGRAM" mode.*

2.5.2.2 Remote Programming Example

Remote programming of the 6031 plug-in is accomplished through a PC or Terminal.

To program the 6031 plug-in for the settings in this example, follow the steps outlined below after the appropriate connections have been made.

NOTE: *Refer to the Mainframe Manual for a complete listing of Remote Commands.*

Pressing [DELETE] on your computer or terminal keyboard while the Mainframe is awaiting numeric data will clear the numeric entry. If [DELETE] is pressed while the function keypad is active the entire program routine will be repeated.

1) From the PC or Terminal keyboard, type "G" to enter PROGRAM mode.

2) Since the 6031 plug-in occupies two slots, type a letter "a" through "d" corresponding to the lower of the two slots (channels 1-4) being occupied (for example, type "b" when slots 2 and 3 are occupied.) A Program Summary for that channel is immediately displayed, followed by the prompt:

```
Type 'R' Range
  or 'T' preset
```

3) Type "R" to select the output mode. A prompt such as the one below appears.

```
SELECT RS232
OUTPUT:
 0 = TEXT
 1 = GRAPHICS
 2 = RAW DATA

INPUT x
```

4) Type "0" to select text only. Type "E" to accept this selection. The 626 prints out confirmation of your selection, and prompts you to program the settings for channel A.

```
RS232 OUT:TEXT

A:L-N
```

5) Type "H" to program the voltage high limit for channel A. The following display appears, indicating that the 626 expects a three digit entry.[3]

```
INPUT xxx
```

6) Type "125" to set the high limit at 125 volts. Type "E" to accept this value.

7) Type "L" to program the voltage low limit for channel A. The following display appears, indicating that the 626 expects a three digit entry.

```
INPUT xxx
```

8) Type "105" to set the low limit at 105 volts. Type "E" to accept this value.

9) Type "S" to program the voltage sensitivity for channel A. The following display appears, indicating that the 626 expects a two digit entry.

```
INPUT xx
```

10) Since the desired setting only contains one digit, a leading zero must be entered. Type "05" to set the sensitivity at 5 volts. Type "E" to accept this value.

11) Type "F" to program the frequency sensitivity for channel A. The following display appears, indicating that the 626 expects a two digit entry.

```
INPUT x.x
```

12) Type "0.2" to set the sensitivity to 0.2 Hz. Type "E" to accept this value.

13) Type "I" to program the impulse sensitivity for channel A. The following display appears, indicating that the 626 expects a four digit entry.

```
INPUT xxxx
```

14) Since the desired setting only contains two digits, leading zeros must be entered. Type "0050" to set the sensitivity to 50 volts. Type "E" to accept this value.

---

[3] If the desired entry is less than three digits, enter leading zeros so that the expected number of digits are entered.

15) Press the "<" key to progress to channel B, the next channel to be programmed. A prompt such as the following is printed:

```
B:N-G
```

16) Type "H" to program the voltage high limit for channel B. The following display appears, indicating that the 626 expects a two digit entry.

```
INPUT xx
```

17) Type "12" to set the high limit at 12 volts. Type "E" to accept this value.

18) Type "I" to program the impulse sensitivity for channel B. The following display appears, indicating that the 626 expects a three digit entry.

```
INPUT xxx
```

19) Since the desired setting only contains two digits, a leading zero must be entered. Type "010" to set the sensitivity to 10 volts. Type "E" to accept this value.

20) Type "FNC" to progress to channel C, the next channel to be programmed. A prompt such as the following is printed:

```
C:AMPS
```

21) Type "H" to program the voltage high limit for channel C. The following display appears, indicating that the 626 expects a two digit entry.

```
INPUT xx
```

22) Since the desired setting only contains one digit, a leading zero must be entered. Type "05" to set the high limit at 5 amps. Type "E" to accept this value.

23) Type "P" for a program summary to verify the settings you just set. The summary resembles the sample below:

```
RS-232 OUTPUT TEXT

A: L-N
V HIGH LIMIT 125 V
V LOW LIMIT  105 V
VOLTAGE SENS 005 V
FREQ SENS    0.2HZ
IMPULSE SENS 050 V

B:N-G
HIGH LIMIT   012 V
IMPULSE SENS 010 V

C:Amps
HIGH LIMIT   005 A
```

NOTE: *After programming the Series 626 plug-ins, be sure to place the Mainframe's in the "OPERATE" mode by typing "O". The Series 626 will not record events while in the "PROGRAM" mode.*

2.5.3 Factory Preset Program

The factory preset program is a default setting for the 6031 plug-in's programmable parameters. The plug-in reverts to the factory preset program whenever a "Memory Invalid" condition exists, or when the Operator presses the PRESET key while in the PROGRAM Mode with the appropriate module slot selected.

2.5.3.1 Selecting the Factory Preset Program (locally)

To select the factory preset program from the 626 Mainframe's control panel, follow the steps outlined below.

1) Set the FUNCTION key switch on the Mainframe's front panel to "PROGRAM".

2) Since the 6031 plug-in occupies two slots, push the lower of the two black buttons of the two slots being occupied (for example, press [2] when slots 2 and 3 are occupied.) A Program Summary for that channel is immediately printed.

3) The cueing indicator next to the [RANGE] key lights.

4) Press the [PRESET] key to recall the factory preset program. A summary of the new settings is printed, as in the example below.

```
PROGRAM SUMMARY

A: L-N
V HIGH LIMIT 132 V
V LOW LIMIT  108 V
VOLTAGE SENS 003 V
FREQ SENS    0.5HZ
IMPULSE SENS 0100V

B: N-G
IMPULSE SENS 0100V
V HIGH LIMIT 010 V

C: AMPS
HIGH LIMIT   010 A
```

NOTE: *After programming the Series 626 plug-ins, be sure to set the FUNCTION key switch on the Mainframe's front panel to "OPERATE". The Series 626 will not record events while in the "PROGRAM" mode.*

2.5.3.2 Selecting the Factory Preset Program (Remotely)

To select the factory preset program from a terminal (or PC in terminal emulation mode):

1) From the PC or Terminal keyboard, type "G" to enter PROGRAM mode.

2) Since the 6031 plug-in occupies two slots, type a letter "a" through "d" corresponding to the lower of the two slots (channels 1-4) being occupied (for example, type "b" when slots 2 and 3 are occupied.) A Program Summary for that channel is immediately displayed, followed by the prompt:

```
Type 'R' Range
  or 'T' preset
```

3) Type "T" to recall the factory preset program. A summary of the factory preset program appears on the screen, as in the example below.

```
PROGRAM SUMMARY

A: L-N
V HIGH LIMIT 132 V
V LOW LIMIT  108 V
VOLTAGE SENS 003 V
FREQ SENS    0.5HZ
IMPULSE SENS 0100V

B: N-G
V HIGH LIMIT 010 V
IMPULSE SENS 0100V

C: AMPS
HIGH LIMIT   010 A
```

NOTE: *After programming the Series 626 plug-ins, be sure to place the Mainframe's in the "OPERATE" mode by typing "O". The Series 626 will not record events while in the "PROGRAM" mode.*

2.5 DESCRIPTION OF DATA PRINTOUTS

Disturbances detected by the 6031 plug-in are sent to the serial port; if the Mainframe's printer is enabled, disturbances are also sent to the thermal printer as they are detected.

If the Mainframe is a 626G, a graph of the disturbance event (except frequency events) is printed with the text information.

With any model of Mainframe, a Graphics Printer (or similar) can be connected to the Mainframe's serial port to obtain graphical disturbance printouts. (When programming the 6031, the user selects the format -- graphics, raw data, or text only -- of the event data sent to the serial port.)

The examples shown in Subsections 2.5.1 through 2.5.6 are of the text information that would be printed when the 6031 detects that particular type of event.[4]

When viewing event data, be aware that channels B and C do not have Undervoltage or Sag events, and that channel C does not have impulse events.

NOTE: *If a Graphics Printer (or similar) is connected, you should disable the Mainframe's printer, since its display is repetitive with the Graphics Printer's display. Pressing [PRINT] will disable the Mainframe's printer; pressing [PRINT] again (toggle button) re-enables it.*

[4] In the sample printouts of subsections 2.5.1 through 2.5.5, voltage levels are based on waveform RMS values.

2.5.1 Overvoltage

An overvoltage condition exists when the monitored power line voltage exceeds the user-specified upper limit for more than 2.55 seconds. An overvoltage condition is indicated by a printout such as the following:

```
4A HI   09:46:07.11
```

where 4 is the Mainframe channel number, A is the plug-in channel, and time is given in hours, minutes, and seconds (to the 0.01 second resolution).

When the line voltage returns to normal (within limits), a printout such as the following occurs:

```
4A NOR 09:46:15.20
   148.6 V  MAX
```

The printout indicates the time when normal voltage was restored and the highest voltage reached during the overvoltage interval.

2.5.2 Undervoltage

An undervoltage condition exists when the monitored power line voltage remains below the user-specified lower limit for more than 2.55 seconds. An undervoltage condition is indicated by a printout such as the following:

```
4A LO   09:46:16.31
```

When the line voltage returns to normal (within limits), a printout such as the following occurs (see next page):

```
4A NOR 09:46:18.45
   36.4 V  MIN
```

The printout indicates the time when normal voltage was restored and the lowest voltage reached during the undervoltage condition.

2.5.3 Voltage Change

A voltage change printout is triggered when the line voltage changes more than a preselected amount from the last printed value. For channel A, the voltage change sensitivity is a user-selected integer voltage between 2 and 60 volts. For channel B, the voltage change sensitivity is 12.5% of the user-programmed high voltage. For channel C, the current change sensitivity is 12.5% of the user-programmed high current.

The following example shows an increase to 116.4 volts followed by a decrease to 114.2 volts at the times shown (assume 2 V sensitivity).

```
2A DEC 01:02:35.08
   114.2 V
2A INC 01:02:34.56
   116.4 V
```

2.5.4 Voltage Surge

A Voltage Surge is defined as a line voltage which increases through a user-selected upper limit and then returns to an in-tolerance condition in less than 2.56 seconds. When a surge begins, its starting time is printed as follows:

```
4A HI  09:45:33.15
```

When the line voltage returns to a normal level following a Surge condition, a message such as the following is printed:

```
4A NOR 09:45:33.38
   128.2 V  MAX
   SURGE 0.23 SEC
```

The printout indicates the time when the voltage returned to normal (within limits), as well as the highest voltage reached and the surge duration.

2.5.5 Voltage Sag

A Voltage Sag is defined as a line voltage that decreases below the user-selected lower limit and then returns to an in-tolerance condition in less than 2.56 seconds. Sag printouts take the same form as surge printouts, with the terms SAG replacing SURGE, MIN replacing MAX, and LO replacing HI. When a sag begins, its starting time is printed as follows:

```
4A LO  09:45:34.25
```

When the line voltage returns to a normal level following a Sag condition, a message such as the following is printed:

```
4A NOR 09:45:34.40
   102.2 V  MIN
   SAG 0.26 SEC
```

NOTE: *Inputs of less than the following values are printed as 0:*

Channel A	*10 V RMS*
Channel B	*1 V RMS*
Channel C	*0.5 A RMS*

2.5.6 Impulses

"Impulse" disturbances represent any line perturbation which contains frequency components in the 300 Hz to 500 kHz range. An impulse-type disturbance produces a printout such as the following:

```
2A IMP 10:12:13.45
  0139 V, 0010 US
```

The printout indicates that an impulse which deviated from normal line voltage by 139 volts, peak, and with a 10 microsecond duration, was detected on Channel 2A (Mainframe Channel 2, plug-in Channel A) of at the time shown. The impulse magnitude is measured with respect to the instantaneous point on the power frequency sine wave where it occurs.

2.5.7 Frequency Change

A frequency change printout is triggered whenever the line frequency changes by more than a preselected amount from the last printed value. The frequency change sensitivity is a user-selected value between 0.2 Hz and 3.0 Hz (in 0.1 Hz increments). The following example shows several frequency change printouts (assume a frequency sensitivity of 0.5 Hz).

```
3 FRQ 10:16:27.02
   060.5 HZ
3  FRQ 10:16:24.32
   060.0 HZ
3  FRQ 10:16:17.02
   059.5 HZ
```

NOTE: *When using a Graphics Printer, frequency change disturbance will not cause a corresponding graph to be printed.*

2.6 DESCRIPTION OF GRAPHICS PRINTOUTS

Graphic printouts can be obtained from either the 626G Mainframe's printer or from a Model 626GP Graphics Printer[5] connected to any model of Mainframe (with the Mainframe's serial port output set to "graphics").

Graphs are plotted for each disturbance (with the exception of frequency events) as long as there is sufficient memory to store the event.

NOTE: *If two or more disturbances on the same channel are recorded with the same time stamp, one graph is plotted containing all events with that time stamp.*

Text data is stored in the Mainframe's memory until it is sent to the RS-232 port or printer. Graphic data is stored in the 6031's memory until it is sent to the RS-232 port or printer. The graphic memory in the 6031 plug-in is capable of storing 24 cycles worth of data. Since three cycles are required for each graph, eight graphs can always be printed and as many as 20 may possibly be printed.[6]

---

[5]Refer to the Graphics Printer Operator's manual for more information on operating your 6031 plug-in with a Graphics Printer.
[6]The exact number of graphs stored cannot be determined since it is affected by the number of disturbances and the time elapsed between them.

When the graphic memory is full, the 6031 plug-in continues to monitor and print disturbances, but in text only. The graphical printouts resume when there is sufficient free memory.

Examples of graphic printouts are included in the following subsection.

2.7 VARIOUS PRINTOUT MODES

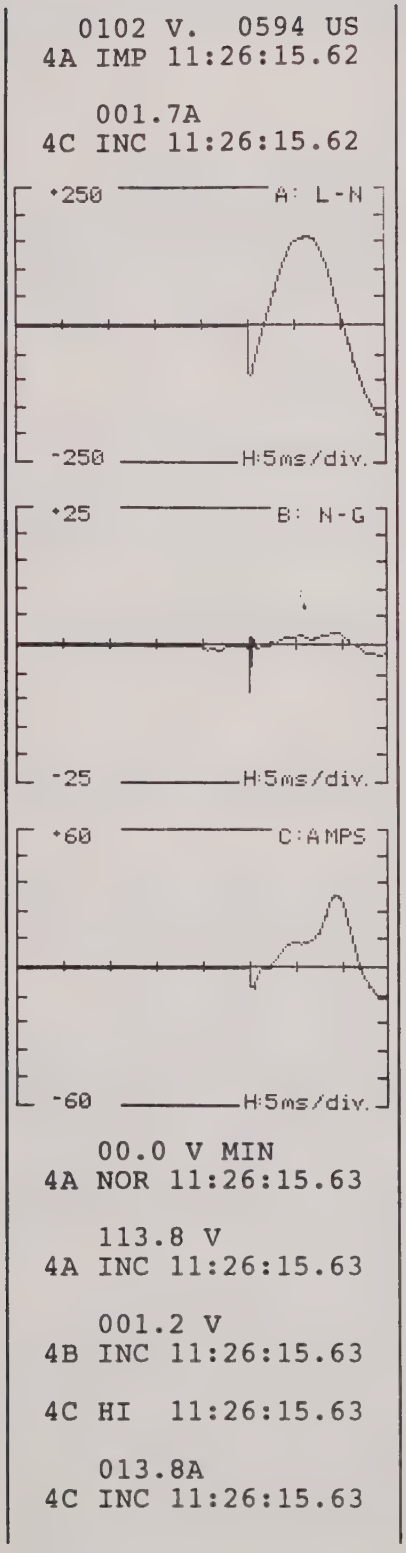
The setting of the PRINTOUT MODE key switch on the front panel of the Series 626 Mainframe determines the amount of detail which is printed from any disturbance. The further clockwise the key is turned, up to the SYSTEM CHECK position, the more detail that is printed regarding a disturbance. Below is a list of the four key switch positions and the amount of detail printed when the PRINTOUT MODE is in each position.

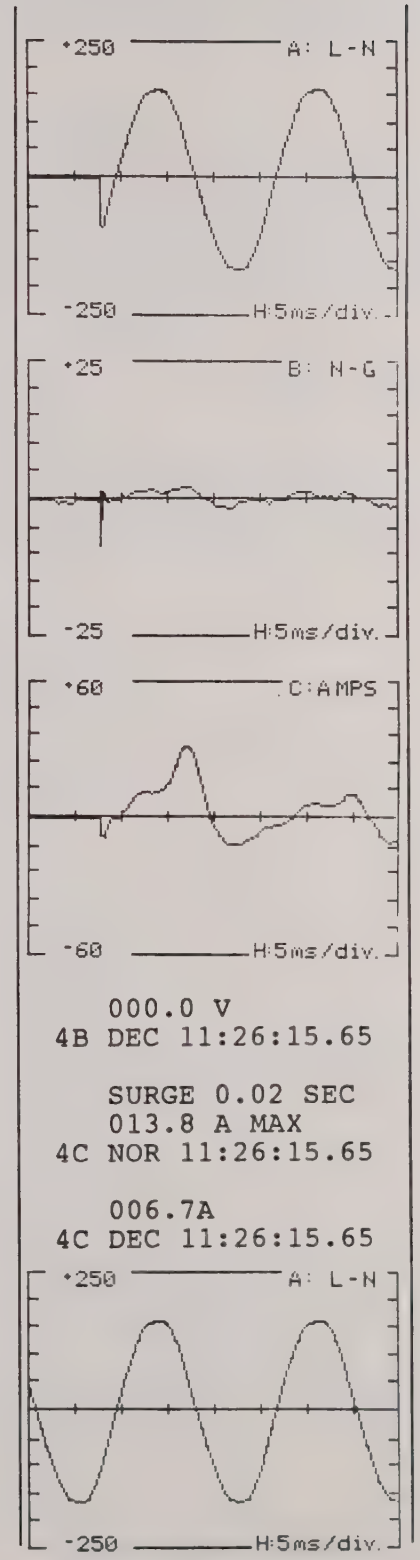
MAXIMUM DETAIL	Maximum detail records all changes. When graphics are printed, an event on any channel causes a graph from all active channels to be printed.[7]
NORMAL	Normal detail records increments and decrements out of the normal range. When graphs are printed, an event on channel A causes a graph from all active channels to be printed; an event on channels B or C cause a graph to be printed from that channel only.
OUT-OF-LIMITS-ONLY	Out of limits records only when limits are crossed. Increments and decrements are not recorded. The averaged sensitivity deviations such as voltage and frequency changes are not recorded. When graphs are printed, an event on channel A causes a graph from all active channels to be printed; an event on channels B or C cause a graph to be printed from that channel only.
SUMMARY ONLY	Summary Only records only the number of hits and the worst case in each category. Disturbances which occur while the PRINTOUT MODE switch is in the SUMMARY ONLY position do not generate individual printouts, but are stored in the Series 626's daily accumulator. A daily summary is printed at midnight (Series 626 time), or when the black [DATA] button is pressed.

Printouts of OUT OF LIMITS, NORMAL DETAIL, and MAXIMUM DETAIL modes are illustrated on the following pages.

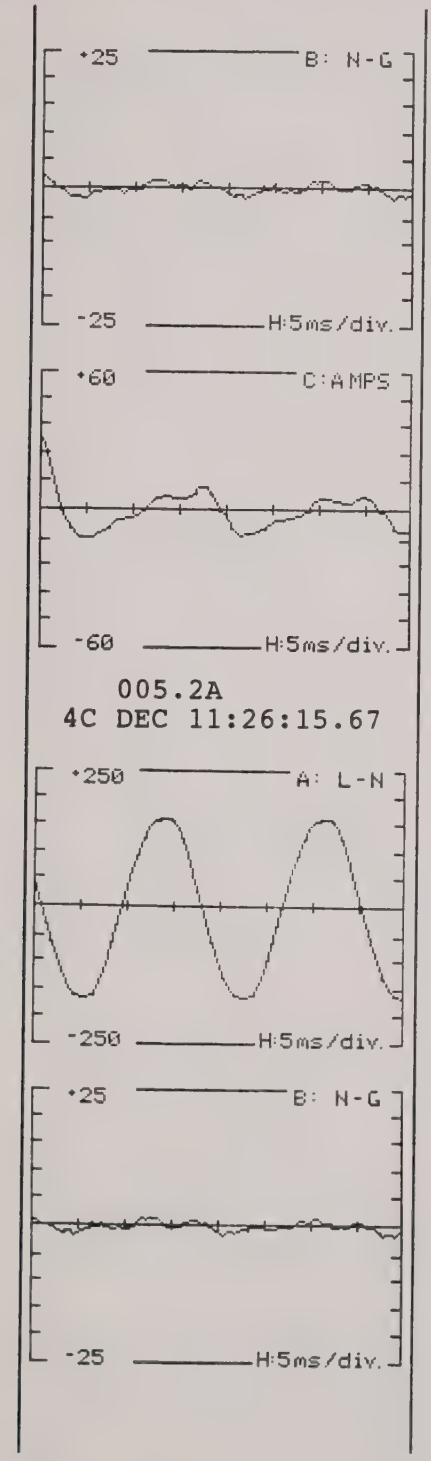
[7]See Technical Specifications for more details.

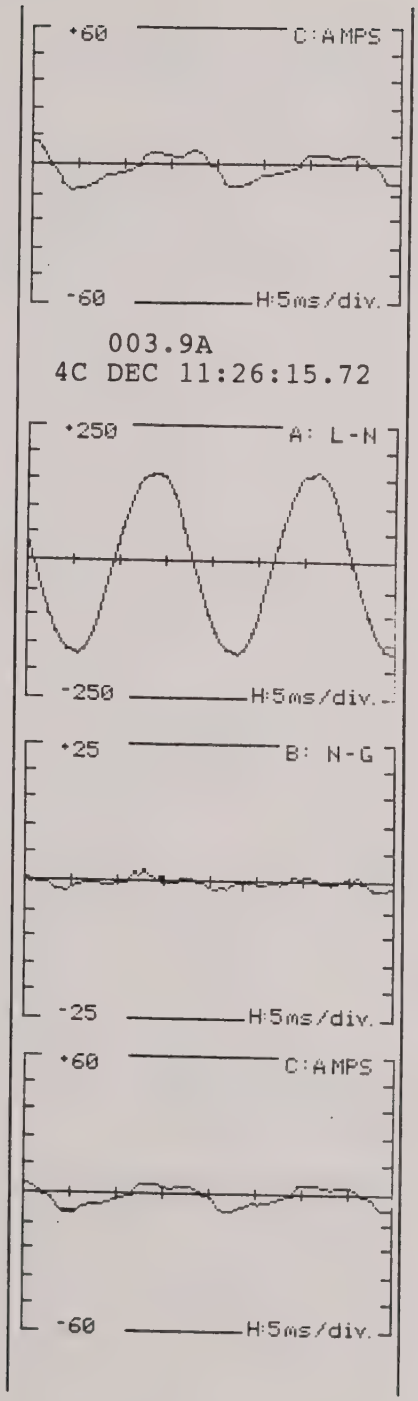
MAXIMUM DETAIL MODE



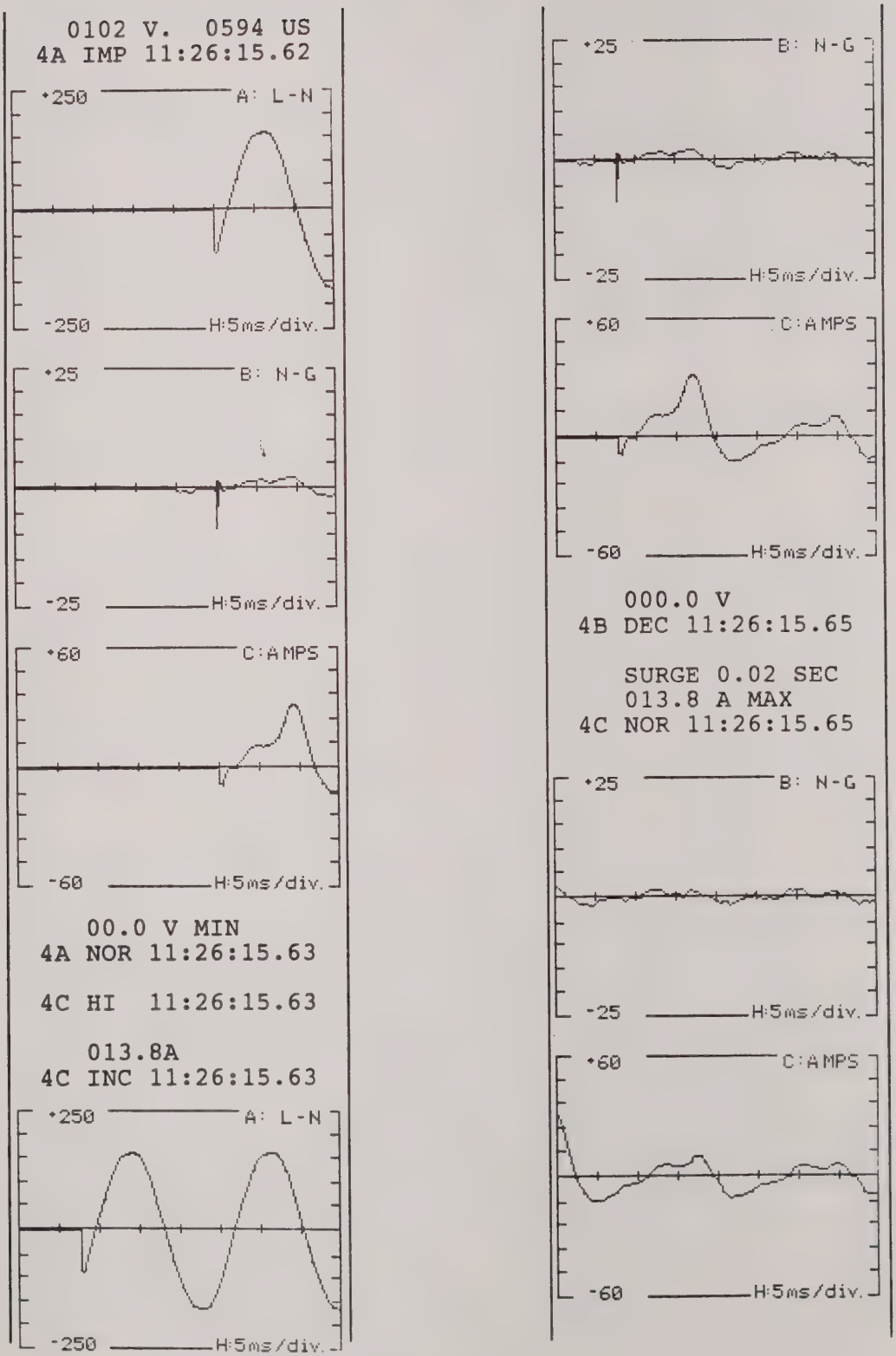


MAXIMUM DETAIL MODE CONTINUED

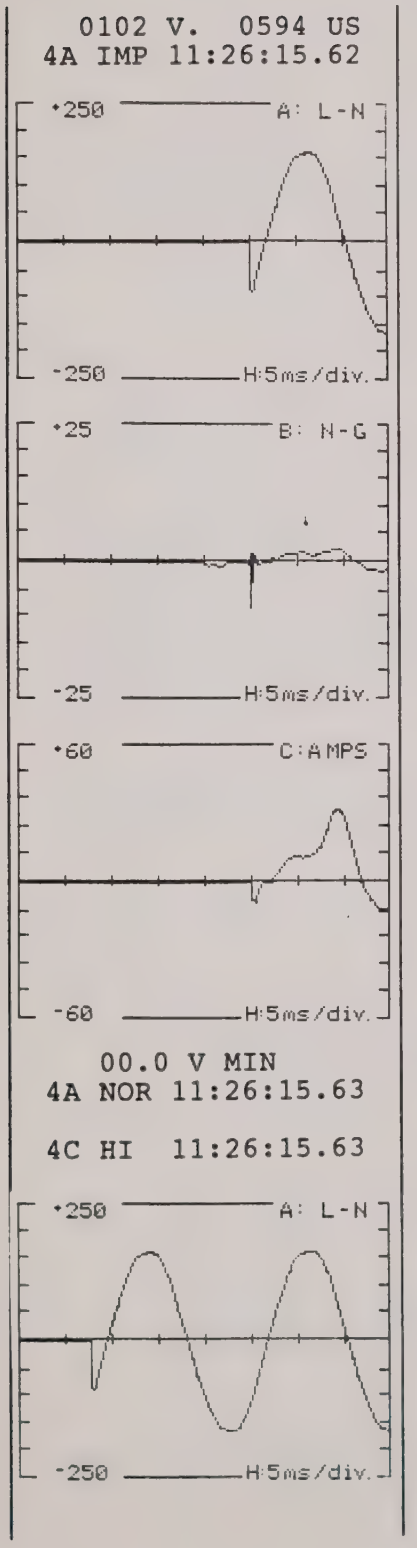


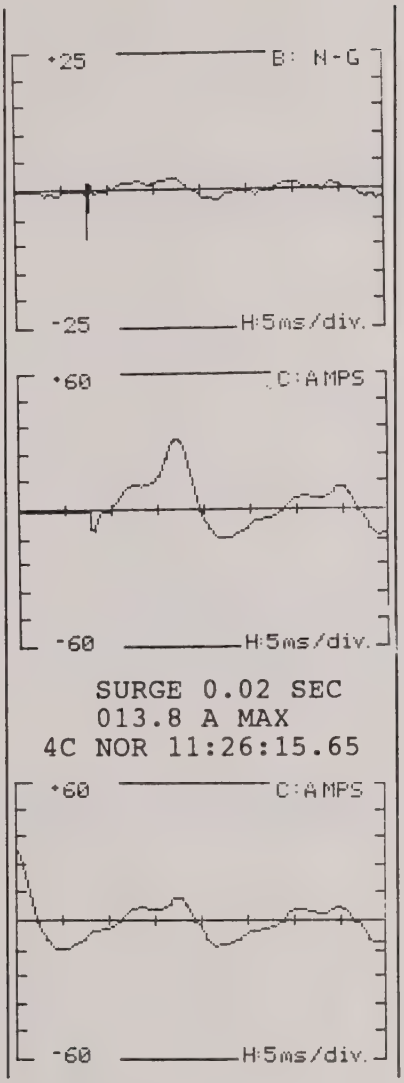


NORMAL MODE


0102 V. 0594 US
4A IMP 11:26:15.62
+250
A: L-N
-250
H:5ms/div.
+25
B: N-G
-25
H:5ms/div.
+60
C:AMPS
-60
H:5ms/div.
00.0 V MIN
4A NOR 11:26:15.63
4C HI 11:26:15.63
013.8A
4C INC 11:26:15.63
+250
A: L-N
-250
H:5ms/div.
+25
B: N-G
-25
H:5ms/div.
+60
C:AMPS
-60
H:5ms/div.
000.0 V
4B DEC 11:26:15.65
SURGE 0.02 SEC
013.8 A MAX
4C NOR 11:26:15.65
+25
B: N-G
-25
H:5ms/div.
+60
C:AMPS
-60
H:5ms/div.

OUT-OF-LIMITS-ONLY MODE





SECTION III
OPERATIONAL TEST

3.1 GENERAL

This section provides information for performing an operational test to verify that the 6031 plug-in is operating properly.

3.2 SYSTEM CHECK

To perform the built-in self-diagnostic operational test, follow the steps outlined below.

NOTE: *The Series 626 must be pluged in and turned on before performing the operational test.*

1) Turn the PRINTOUT MODE key on the front panel of the Mainframe momentarily to the "SYSTEM CHECK" position, and then back to "NORMAL."

   When the PRINTOUT MODE key switch is turned to "SYSTEM CHECK," a source of precise signals is applied to the front-end circuitry of the 6031 plug-in. Any inputs connected at this time will be automatically disconnected during the system check period. Successful measurement of these signals verifies that the plug-in module is fully operational.

2) Compare the actual displayed readings with those in subsection 3.2.1 below. If any readings are out of range, contact Dranetz Customer Service Department for further instructions (see subsection 1.9, FACTORY REPAIR.)

3.2.1 System Check Tolerances

The acceptable ranges for the system check tolerances are listed in TABLE 3-1 below.

TABLE 3-1. SYSTEM CHECK TOLERANCES

AC Voltage	A: L-N 196.0 to 204.0 V B: N-G 19.6 to 20.4 V C: Amps 19.6 to 20.4 A
Impulse Peak	A: L-N 1800 to 2200 V B: N-G 180 to 220 V C: N/A
Impulse Duration	A: L-N 8 to 12 µSec B: N-G 8 to 12 µSec C: N/A
Frequency	59.8 to 60.2 Hertz

3.2.2 Example System Check Printout

The display on the following page illustrates an example System Check printout of a 6031 plug-in.

```
***SYSTEM CHECK***
05/30/90  13:14:55

        CH 4
   626-PA-6031G
FRQ     060.0 HZ
    INPUT A
PRESENT      199.6V
IMP  1996V, 0011US
    INPUT B
PRESENT      020.4V
IMP  0204V, 0011US
    INPUT C
PRESENT      020.3A

******************
```

The above printout verifies the operational integrity of the 6031 plug-in for all three measurement channels (A, B, and C). The plug-in passes the System Check because all values are within the tolerances of TABLE 3-1.

APPENDIX A
EXTERNAL PRINTER

A.1 GENERAL

The Series 626 or 626A Mainframe's front panel printer cannot produce graphic displays; the 626R does not have its own printer; therefore, an external printer must be used when graphs are required. The 6031 plug-in is designed to be used in conjunction with the Dranetz Model 626GP Graphics Printer, however, it is also possible to use the 6031 plug-in with other printers. The information in the following subsections provides information on how to use the plug-in with an Epson FX-100+ (or compatible) printer. (The 626G can print graphics, therefore an external printer is not needed.)

The external printer used must be connected to the Mainframe's serial port. Be sure that the plug-in is in the graphics output mode.

A.2 TRANSMISSION OF GRAPHICS DATA

Graphics data is only available at the Series 626 Mainframe's RS-232C port which is located on its rear panel (DCE Communications port, connector J2).

When transmitting graphics information, the data format is:

- 8 bits,
- no parity
- and 2 stop bits.

DTR handshaking is used on the Series 626. The control codes used by the 6031 plug-in are Epson FX-100+ compatible as listed in the following examples. In the examples, "$" indicates a hexadecimal number and "CHR$( )" indicates a character string not an ASCII character. ASCII characters are indicated by "A", "K", "O", "ESC", etc.

NOTE: *The Series 626 Mainframe's Communications Port must be set to at least 1200 baud, its default, or else the time it will take to print graphs will be impractical.*

Control Codes used by the
Graphics Printer and Epson FX-100+ Printer

Control Codes for Line Spacing:

"ESC","O" = $1B,$30 ..... Sets line spacing for text mode.

"ESC","A",CHR$(8) = $1B,$41,$08 ..... Sets line spacing for graphics mode, line spacing is approximately 8/72 inch standard.

Control Codes for Dot Graphics:

"ESC","K",CHR$(nl),CHR$(n2) ..... Turns on graphics mode where nl,n2 form a 16-bit binary number indicating the number of graphics columns to print. The lsb is nl=n(MOD 256); the msb is n2=INT(n/256)

For Example: To send 320 columns of graphics, the following string of characters would be transmitted:

"ESC","K",CHR$(64),CHR$(1) = $1B,$4B,$40,$01

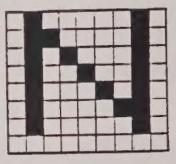
Graphics columns are encoded as follows:

The TRUE state of "1" causes a dot to be printed. The least significant bit (lsb) of the number transmitted controls the lowest dot of the 8-dot column. The most significant bit (msb) of the number transmitted controls the highest dot of the 8-dot column.

For Example: The graphic string:

$00,$FE,$40,$20,$10,$08,$04,$FE,$00

would print the letter "N" as illustrated below.



RS-232C Pin Connections:

The RS-232C signals used by the Series 626 are described in Table A-1 below along with the connections to a compatible printer.

Table A-1. RS-232C Signals used by the Series 626

Pin	Name	Direction	Description
1	GND	N/A	Shield of interface cable should be connected to this pin which is tied to the frame ground internally to the Series 626.
2	XMT	To Series 626	Serial data outputted from connected device is sent to the Series 626. RTS and DTS must be TRUE for the data to be recognized.
3	RCV	From Series 626	Serial data is outputted by the Series 626 to the connected device provided DTR and RTS are TRUE.
4	RTS	To Series 626	Used to temporarily suspend transmission of data from the Series 626 in the Graphics Mode. This signal must be TRUE for the Series 626 to recognize the presence of a connected device. A FALSE state for more than 10 seconds* will cause the "RS-232C PORT LOST" message to be printed and appropriate action to be taken.
5	CTS	From Series 626	This signal will be TRUE as long as the ACIA and driver circuitry of the RS-232C port of the Series 626 are operational.
7	GND	N/A	Signal ground, internally connected in the Series 626 to pin 1.
20	DTR	To Series 626	This signal must be TRUE for the Series 626 to acknowledge the presence of a connected device. FALSE state causes an immediate disabling of the port.

* - This is true only when printing graphics information. When printing text messages, 240 milliseconds if the maximum time that this signal can be FALSE.

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